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NEW LIGHT ON SOME BOROBUDUR PROBLEMS

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Aerial view of Borobudur
(Courtesy KLM & Aerocarto - Indonesia)

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1. Borobudur in grave danger

Borobudur was simply a mound of rubble and earth, overgrown with shrubs and trees, when it was rediscovered in 1814. A total clean-up that followed soon, transformed it into a huge monument that later on became well-known all over the world.

Minor excavations and restaurations, carried out at intervals during the 19th century, rescued it for ever from further oblivion. Towards the end of the century, however, it was realised that the upkeep of such a big monument required more than incidental repairs only. And so huge plans regarding what would be the best way to secure its soundness were made and taken into the most serious considerations, leading finally to the Government's decision to restore it as far as possible.

It was Th. van Erp, a man of genius, to whom credit was given for the execution of this large scale restoration. Within 4 years, from 1907 till 1911, he acquitted himself of this formidable task. And it is to him, indeed, that the present generation is indebted for the regained greatness of Indonesia's most magnificent historical monument.

Van Erp apparently did not think it necessary to dismantle the slanting walls and the sagging floors. It might have been because of financial considerations, but it is true that his ingenuity found out the solution with regard to the keeping in balance of the walls and the floors by means of the construction of new, reinforced floors over the entire galleries and platforms.

And Van Erp's calculations and technical precautions prove to be quite reliable, at least during the following 50 years.

Due to the complete confidence that Van Erp always had enjoyed from the Archaeological Service of Indonesia, the saggings and even the leaning walls were further taken for granted. Only regular observations and measurings were carried out as a routine work.

Special attention was therefore paid to the physical alterations of the surface of the stones, that showed more and more evidences of deterioration. With regard to this particular phenomenon UNESCO was asked for its advices in 1956. And her expert, the late Professor Coremans, came after one month of minute examinations to the conclusion that the main and fundamental cause of the degradation of the stones was: water. He was not able, however, to recommend the proper means of how to stop definitely the harmful

effects of the moistness of the stones, without creating new harmful agents of another kind.

In 1959 the discovery of an alarming deviation in the leaning process of the walls diverted the attention towards the moisture problem. Measurings and levellings showed that certain parts of the leaning walls followed quite another way of development than could be expected. According to the figures those parts were developing into an upright position!

A close examination pointed out that the measurings were very much distracted by bubblings on the surface of the walls. Some of those bubbles even covered the whole middle part of the walls, so that it became very clearly visible that several stones had shifted from their original places while new cracks were found at many spots.

Moreover, an intensive survey all over the leaning walls brought to light that irregularities in the development of the slanting and sagging process were found in many other parts of the monument, though not of the same kind.

A further investigation towards the cause of the bubblings and other irregularities led to the conclusion that again water was the greatest enemy. Around those particular places the flowing away of the water inside the monument was apparently retarded due to the less permeability of the soil. The accumulation of water of course brings pressure to bear upon those parts of the walls, so that a shift in a horizontal direction takes place.

As the presence of such an unexpected force had always been excluded from any calculation, it was found out that continuous observations and regular measurings were no longer allowable. The less so, as the process of decay will naturally go on in an accelerated pace.

And that is why it is only reasonable that in 1960 the Archaeological Service drew the Government's attention to the alarming condition of Indonesia's greatest monument by declaring: Borobudur is in grave danger!

2. The problem of safeguarding

It is a matter of fact that a monument in the open air is exposed to rainfall and sunshine, and subject to cold and heat, alternating by the turning of wet and dry seasons and of day and night. It is quite impossible to prevent it from the destructive effects of weathering processes. A total isolation from the air, by chemicals for instance, will certainly do more harm, as the stones must keep «breathing». So another means should be looked for. And in doing so, a thorough study of the weathering process should be carried out.

As said, the main cause of deterioration is the harmful effect of water. The rainwater penetrates the monument through the vertical seams between the stones of the galleries and the platforms, and also through the holes in the porous stones themselves. It further flows downwards along the slopes of the hill inside the structure, while binding minerals and salts from the eroding earth. It then penetrates the lower lying walls of the monument in an outward direction through the horizontal seams and holes and evaporates at the surface of the stones.

It stands to reason that the above simplified course of things is only partially true. Much of the water remains inside the monument, being kept by the earthen core

as well as by the stones that are not exposed to the air. And that is why Borobudur is always moist, even in the dry season.

Keeping in mind the harmful effects of water, four main trends of destruction can now be distinguished:

1. the ever moistness of the stones of the monument furnishes a fertile soil for all kinds of fungi and lichens;

2. the chemical substances, left behind on the surface of the stones after the evaporation of the water, undergo a process of oxydation with the result that the minerals and salts either become a very hard layer that covers and damages the stones (the so-called stone-cancer) or directly the skin of the stones in the way small-pox does;

3. the continuous erosion of the slopes of the core of the monument weakens the foundations and causes slidings, that results in the saggings and the leanings of the walls;

4. at places where the flow of the water is retarded, a kind of water-bags are formed, and these water-bags bring pressure to bear upon the walls, causing bubbles and other deviations.

Serious considerations with regard to the responsibility towards the safeguarding of Borobudur's soundness led finally to the decision that immediate steps should be taken. The problem has become quite clear, viz. the monument must be kept dry. The method should be to provide it with an appropriate drain system, externally as well as internally. And this will only be possible, if a bold dismantling of the lower 4 stages of the monument can be ventured.

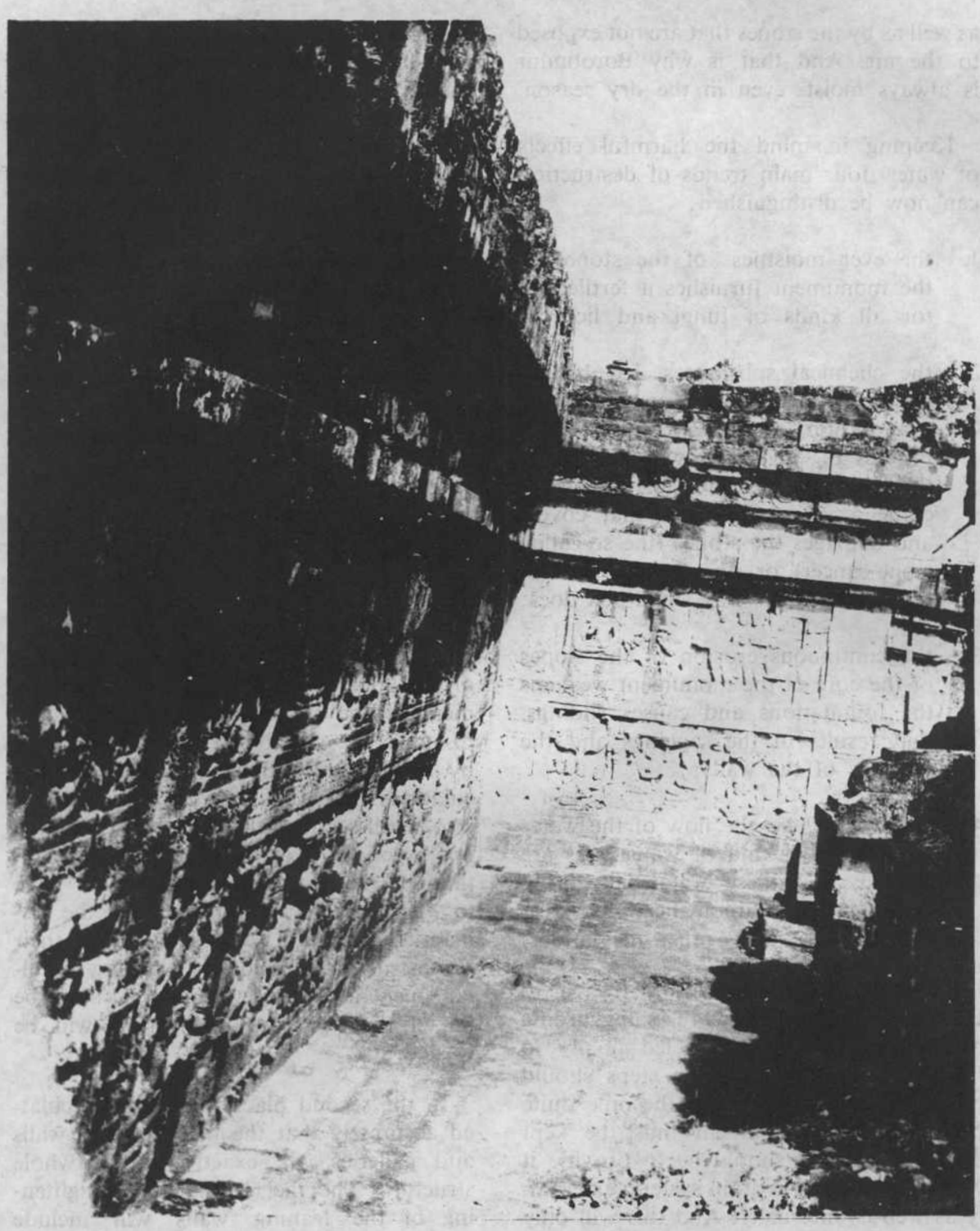
As any other way would not solve the problem forever, it was decided to dismantle, indeed, the lower half of Borobudur, which would involve more than 25.000 cubic meters of stones! This gigantic project will at the same time safeguard Van Erp's pains and merits as well!

On a new, reinforced, solid, concrete foundation, in which a special drain system will be incorporated, the bit by bit dismantled parts of the lower half of the monument will then be rebuilt.

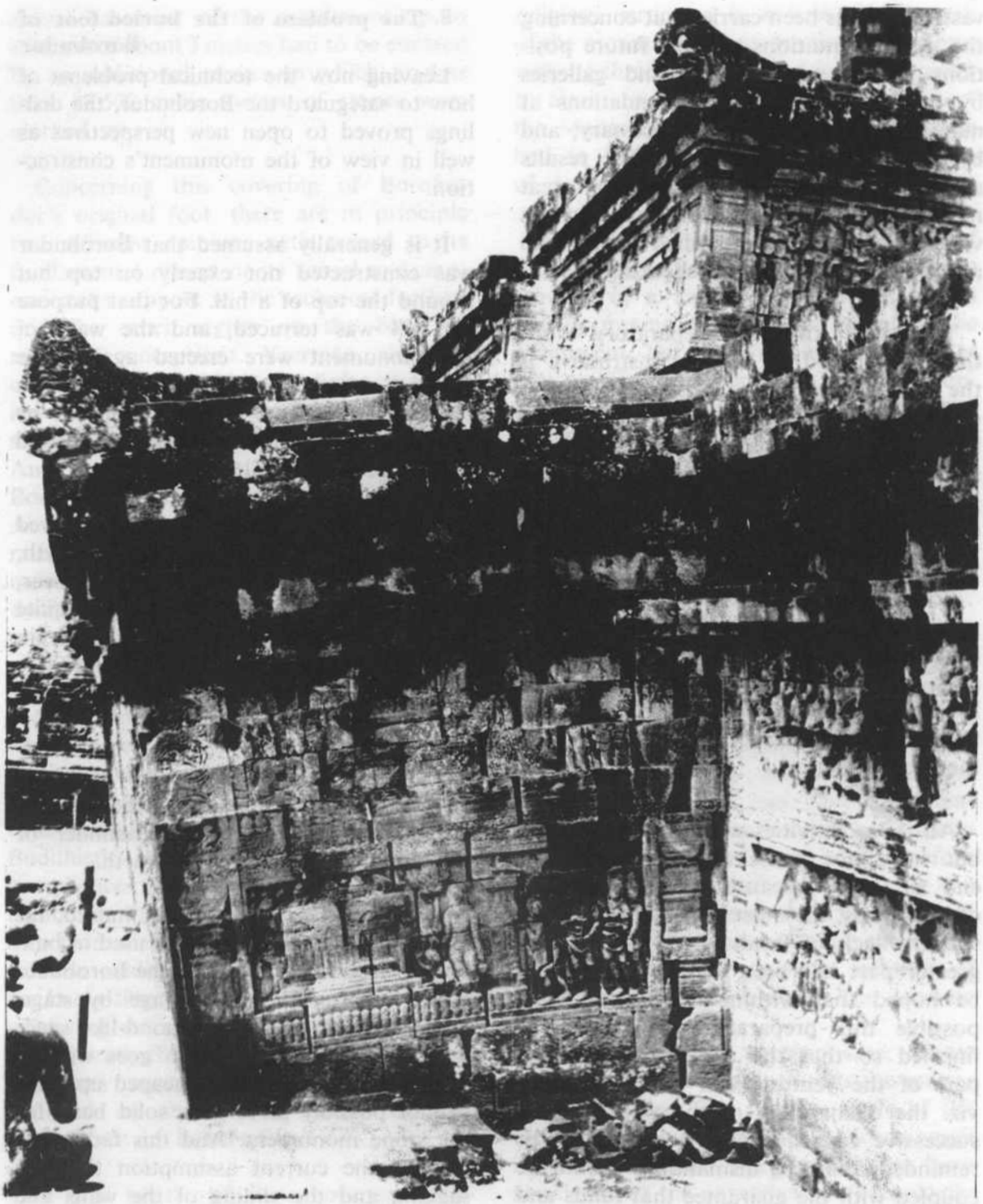
Before starting the actual execution of this formidable project, all kinds of preparatory work must be carried out, in order to guarantee the success of the venture.

In the first place it must be taken into the most earnest consideration that the partial dismantling might cause a collapse of the upper structure, before the replacement of the stones can take place. This disagreeable possibility will be nullified by special precautions and accurate calculations. The walls are, therefore, divided into small sections that will be dismantled one by one at fixed distances. The dismantling of the successive sections will have to wait until the reinforcement of the dismantled parts is completed and their reconstruction started. By working simultaneously at several sections it is to be hoped that not too much time will be wasted.

In the second place it must be calculated accurately that the reconstructed walls and galleries will exactly fit the whole structure. The fact is that the straightening of the leaning walls will include their lifting up, so that their junctions with the untouched upper stages might be disturbed. For this purpose a thorough in-



Leaning and bulging of walls in the North West quadrant
(Photo Arch. Inst.)



First gallery North Side. Widening of the joints on the main wall
(Photo Arch. Inst.)

vestigation has been carried out concerning the actual conditions and the future positions of the sagged walls and galleries by breaking through the foundations at many places as considered necessary, and by measurings and levellings. The results are drawn on paper; and thus a great number of reconstructional cross-sections were produced to be studied further, so as to have a continuous checking.

The third kind of preparatory work that has proved to be very instructive is the drillings through the monument at different places at all stages. A thorough knowledge of the nature of the soil will serve as the basis of designing the appropriate kind of construction of foundation on which the restored monument will rest.

Several other minor, but not less important, kinds of preparatory work have also been carried out, such as the drawing and photographing of the walls, stone by stone, in order to have a checklist of the stones when replacing them during the reconstruction.

All those activities were started in 1963, but have not made headway since the end of 1965, because of several kinds of handicaps, the most important of which was the lack of funds. Even though, the greater part has been completed. It is to be hoped that within the shortest time possible this preparatory work will be finished so that the actual or the main part of the venture, can be carried out, viz. the dismantling of the walls and its successive consequences. It only must be reminded, that the dismantling should be coupled with the guarantee that funds and materials be available all through the years. A sudden stop or even delay might be fatal for the monument!

3. The problem of the buried foot of Borobudur

Leaving now the technical problems of how to safeguard the Borobudur, the drillings proved to open new perspectives as well in view of the monument's construction.

It is generally assumed that Borobudur was constructed not exactly on top but around the top of a hill. For that purpose the hill was terraced, and the walls of the monument were erected against the upright sides. It should mean that the terraced top of the hill was built in by the monument, and that the core would consist of virgin soil.

The drillings, however, have proved that Borobudur's interior is rammed earth, hardened with chips and gravel. Moreover, the kind of earth is at many places quite different of composition than the virgin soil of the hill. On the other hand it is just the same earth as that which is found at the foot of the hill.

The original top of the hill rises not more than 10 metres above the base of the monument, while the remainder of the hill inside is heaped up earth.

It goes without saying that, indeed, the most obvious technique to be used in building a stepped pyramid like the Borobudur is by erecting the walls stage by stage, while filling in the gained pond-like space with rammed earth. It also goes without saying, however, that the heaped up earth cannot possibly serve as a solid basis for the stone monument. And this fact, now, justifies the current assumption that the sagging and the sliding of the walls and galleries already started during the construction of the project, more than 1000 years ago. This is the reason why the

actual basement of the monument up to a height of about 3 metres had to be encased by an additional terrace in which no less than 12.500 cubic metres of stones were worked up.

Concerning this covering of Borobudur's original foot, there are in principle two different opinions with regard to its fundamental reason or its actual meaning: one seeks support in the technical factors, and the other argues on the basis of religious conceptions. Yzerman, the discoverer of the hidden reliefs, thought it was a technical necessity in view of the sliding and the sagging of the structure. And so did Van Erp, the restorer of the Borobudur, in a more convincing way. And many others follow this opinion. The rational character of the explanation agrees quite well, indeed, with the results of the drillings.

Stutterheim, the founder of the other theory, argued that the stone covering had already been foreseen before the whole project was executed, as the builders had particular religious conceptions in view. Borobudur was not meant for laymen who needed representations of the ten Buddhistic ethical rules, the reward for compliance with these and the punishments for their neglects. It was erected as a monument of a higher order, destined for the meditations of the monks. Now we know that monks had to refrain from observing evil things and evil deeds, and consequently they could not and should not have any contact with such scenes as depicted on the hidden reliefs of the buried foot of Borobudur.

It is a matter of fact, however, that the sculptors did carve those scenes in a series of reliefs of more than 300 metres length, as it was apparently a must. A religious structure is a replica on earth of the mountain of heaven, the Mahameru, with its three spheres. And it was in order to attain to a complete representation of the Mahameru that those series of reliefs had to be present, indicating the sphere of desires.

Keeping the reliefs from the sight of monks only would not necessarily imply the use of a terrace of 3 metres height and 6 metres thickness all around the monument, but there is one other matter that has to be taken into consideration. The Mahameru would not be complete without the 'cakrawala' or the iron wall that encircles its foot, cutting it off from the other world and world systems. Thus the additional terrace fitting tightly Borobudur's actual base is to be interpreted as to represent that iron wall!

Though the results of the drillings are in favour of Yzerman and Van Erp I think that — having a religious monument in view — Stutterheim's argumentations ought to be taken into consideration earnestly. Both the technical and the religious conceptions may have equal reasons of existence and may be equally based on firm grounds, and have therefore a fair competence without nullifying the one by the other. Cannot both be combined as to approximate the maximum satisfying, and hopefully final as well, solution of the problem? I think that's the answer.

There is namely another case, where such a combined approach puts the matter beyond dispute. The massive roofs of the chandis are always provided with a small inner space, which intentionally has been saved during the construction. Technically it serves as a means to unburden and to diffuse the formidable weight of the solid stone roof which brings pressure to bear

upon the four walls of the building. It is the genius of our architects of the past that this technical measure at the same time meets the religious need of a special space for the temporary abode of the worshipped deity. The base of the space is for that reason treated and carved as a lotos-seat, while a hole in its center shows the direct communication between this space and the cella beneath, where the statue of the deity is enthroned.

Returning to the Borobudur now, there will be no fundamental problem any longer concerning the buried foot, if we admit a melting together both the technical and the religious conceptions, being the genius ideas of devoted architects, who also took aesthetic values into consideration! And this aesthetic standpoint of view clarifies at the same time the shape as well as the extent of the additional terrace around Borobudur's foot, whether it be a technical support against further sliding or a depiction of the iron wall enclosing the Mountain of Heaven!

4. The problems of the lake around Borobudur

In 1931 Nieuwenkamp launched the fantastic hypothesis that Borobudur was not really meant as a stupa but as a huge lotosflower, floating on a large lake, and thus representing the lotos from which the future Buddha will be born (called Padmasambhawa). The idea was based on his discovery that Borobudur's groundplan resembles, indeed, the lotos rosette, while its situation on top of a hill suggests a floating in the air. Moreover, soundings and levellings gave proof that villages in the area that bear names commencing with the word «Tandjung» (which means 'cape') are all located just above a common elevation line, viz. 235 metres above sea-level. And so are, remarkable enough, the monuments in Borobudur's neighbourhood, such as Chandi Pawon and Chandi Mendut.

Nieuwenkamp came to the conclusion that the Kedu plain beneath the 235 metres elevation line was once a lake, in the middle of which the Borobudur monument floated.

This hypothesis immediately met such a great resistance, while Van Erp succeeded in nullifying it in such a convincing way, that it practically fell into oblivion not long thereafter.

The idea of a lotosflower is indeed too fantastic, but the existence of a lake is worthwhile to be taken into consideration. Further explorations and soundings were, therefore, carried out by geologists, the results of which were to a certain extent in favour of Nieuwenkamp's hypothesis.

The drillings, carried out inside as well as outside the Borobudur for the purpose of the second restauration of the monument and its further safeguarding prove to have dug up this old dispute once again. The discovery that the core of the monument is not a natural hill but an artificial one, and that a fair part of its fillings had apparently been taken from the surrounding areas at the foot of the hill, suggests the probability that certain parts of the present fields had been dug out in such a way that an artificial lake could have come into existence. Aerial photographs show that especially the area south of the Borobudur fits in nicely with the said probability. Many people even remember that this area was a swamp in the early 19th century. And remarkable enough, the village south-west of the monument still bears the name «Sabrangrawa» which means 'on the other side of the swamp!'

The presence of a lake near the Borobudur monument is thus quite plausible, if not proved, though a different one than imagined by Nieuwenkamp.

From the religious standpoint of view a lake or a pond, mostly artificial, as part of a sanctuary is quite in accordance with the religious conceptions, as has been proved many times by excavations (Plaosan, Djawi, Sumberawan, Goa Gadjah, Panataran, and others).

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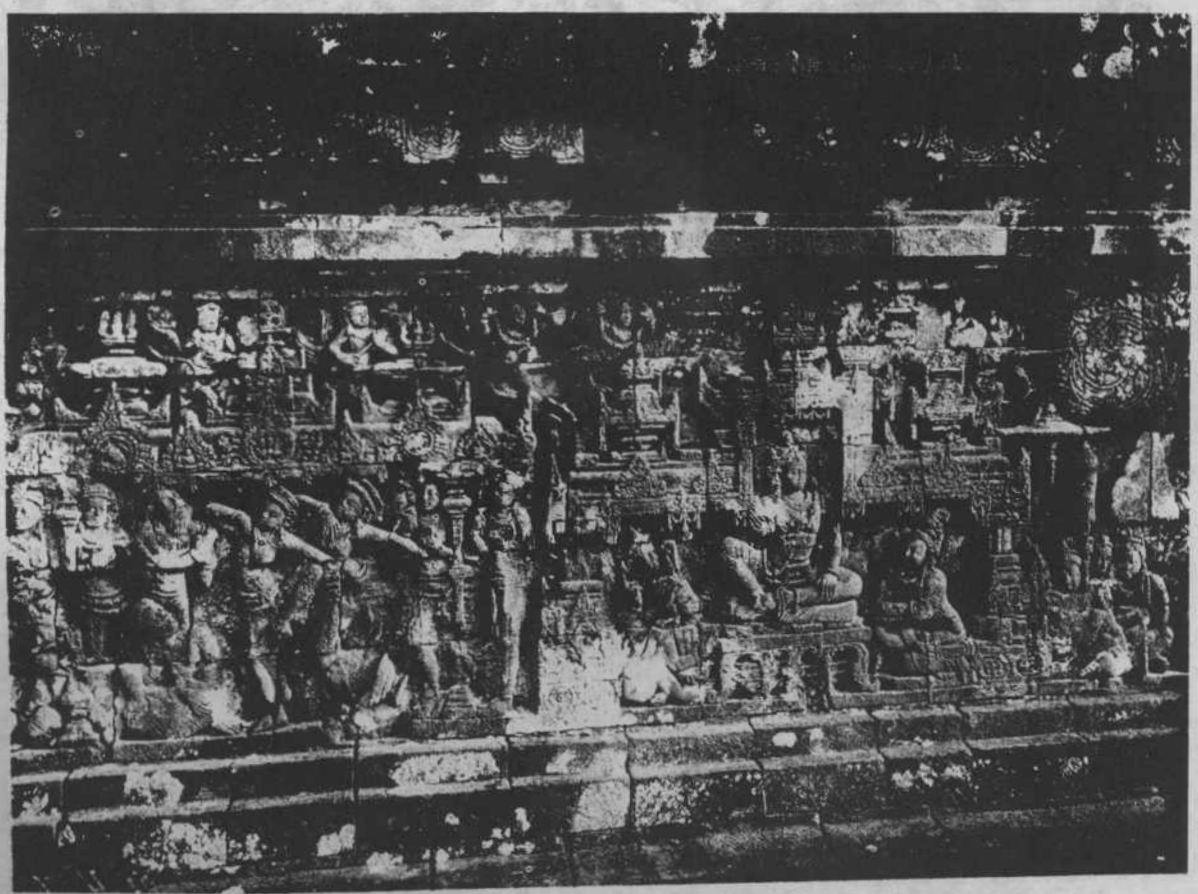
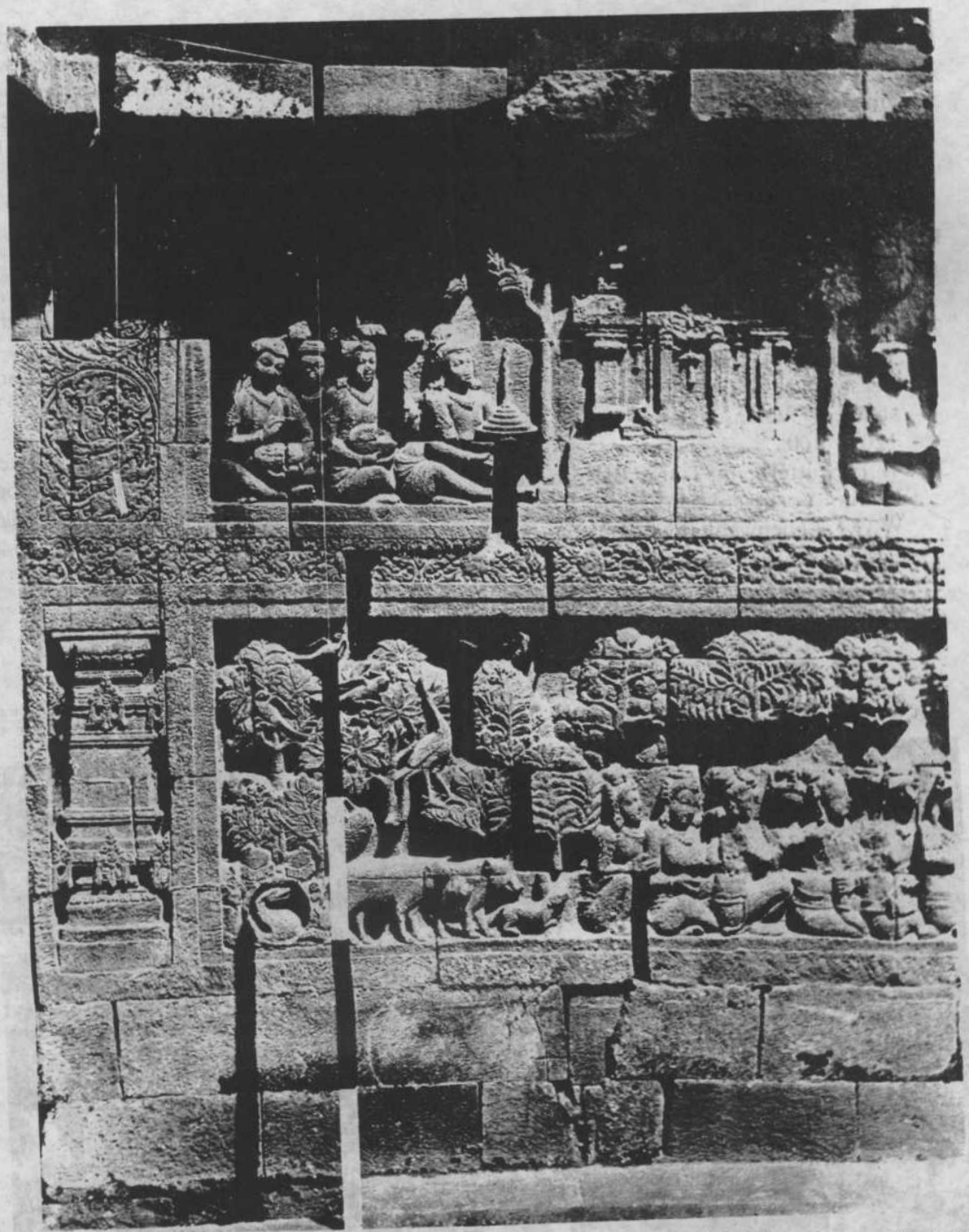
Third gallery northern side. Relief affected by fungi and lichens
(Photo Arch. Inst.)





First gallery of the main wall. Widening of the joint
(Photo Arch. Inst.)